Explosion-proof Pumps

**Explosion-proof Pumps for Hazardous Locations**
Flygt Electric Submersible Explosion-proof Wastewater Pumps are examined, tested, and approved by Factory Mutual Research (FM) as Explosion-proof. They conform to the latest edition of the National Electrical Code (NEC), Articles 500, 501, 502, and 503 requirements as explosion proof and suitable for use in Class I, Division 1, Groups C and D, and dust ignition proof and suitable for use in Class II, Division 1, Groups E, F and G hazardous locations, and suitable for use in Class III, Division 1 hazardous locations. FM approval also meets OSHA (Occupational Safety and Health Administration) requirements.

**Definition of Hazardous Locations by NEC**

**Class I locations** are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosion or ignitable mixtures.

**Class I, Division 1 location** is a location: (1) in which ignitable concentrations of flammable gases or vapors exist under normal operating conditions; or (2) in which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (3) in which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

**Class II locations** are those that are hazardous because of the presence of combustible dust.

**Class II, Division 1 location** is a location: (1) in which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures; or (2) where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes; or (3) in which combustible dusts of an electrically conductive nature may be present.

**Class III locations** are those that are hazardous because of the presence of easily ignitable fibers or flyings but not likely in air suspension in quantities sufficient to produce ignitable mixtures.

**Class III, Division 1 location** is one in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.

**Special Features**
The construction of an Explosion Proof pump is similar in most respects to the standard wastewater pump, but differs in the following details:

1. Hydrostatically pressure tested high strength, cast iron housings are designed to withstand an internal explosion and have long tight flame paths to reduce exit temperature of any exploding gases to a value below the ignition temperature of the surrounding environment.

2. All pumps have required pilot thermal sensors embedded in stator windings, to guarantee that the pump surface temperature never exceeds safe limits, avoiding possible environmental ignition.

3. Externally mounted leakage sensors may not be used unless explosion proof or intrinsically safe (consult factory for details).

4. Special approved power cables required: Flygt SUBCAB.

5. All pumps, except 3045(X), 3057(X), 3085(X), 3102(X) and 3127(X), have a special stator inspection plug. The 3085(X), 3102(X) and 3127(X) stator housings are inspected for leakage through the cable entry. Here, penetration of oil from the oil chamber below, or water from the junction chamber above can be detected.

6. Flygt controls supplied with these pumps incorporate the following required circuits:

   A. Motor pilot thermal sensors (connection is approval mandatory).

   B. Intrinsically safe relays for ENM-10 level sensors (or equal) - usage is mandatory.

**CAUTION:** All controls, used with these pumps but not supplied by Flygt, must be designed according to the latest applicable standards. See Monitoring & Controls Section for additional details and requirements.

**Environmental Limits**
The maximum temperature of exposed (external) pump surfaces is self controlled by the motor pilot thermal switches. Maximum allowed ambient (environmental) temperature is 115°F (46°C).

**Application of Explosion-proof Pumps**
These pumps may be used in sewage wet wells that are classified as Class I, Division 1, Groups C and D.
Explosion-proof Pumps

hazardous locations (gases and vapors). They can also be used in applications that are classified as Class II, Division 1, Groups E, F and G hazardous locations (typified by grain or coal storage); also, Class III, Division 1 locations (fibers and flyings).

Other areas, which may be classified hazardous under normal conditions and where the use of Explosion-proof pumps for handling contaminated wastewater is required are: refineries, petrochemical industry locations, tank farms, gas utility vaults, etc., always taking into consideration that these pumps are not designed or approved as process pumps deliberately and protractedly handling high concentrations of hazardous liquids, e.g.: gasoline, etc.

Limitations
1. CP/CS, DP/DS and FP/FS 3085(X) does not optionally have a terminal board as does the standard version.
2. This Explosion-proof pump is not available in the Warm Liquid (WL) variant.

Division 2, All Classes: For Class I or II locations, a Division 2 designation means that the ignitable or combustible materials will not normally be present in hazardous concentrations except by accident or malfunctions of containing or protective systems. In Class III locations, Division 1 and 2 are almost the same (check NEC Article 503).

Equipment approved as suitable for use in Division 1 locations is automatically suitable for use in Division 2 locations. However, if the Authority Having Jurisdiction has definitely defined the area as Division 2, standard submersible pumps (motors) may be used so long as they do not contain any open (non-hermetically sealed) ignition sources (See NEC Article 501-8 and 502-8) and use motor pilot thermal switches to limit surface temperatures. Standard Flygt submersible pumps meet these requirements.

Classification
A sewage wet well (or any other wastewater collection location) is not automatically a hazardous location. The nature and classification of any location must be determined and indicated by whoever is considered to be the Authority Having Jurisdiction.

This Authority is not always easily determined. Care and diligence must be exercised to make sure, once a preliminary identification has been made, that there is not some other superseding Authority.

Depending on the type and geographical position of the “location”, the Authority may range the gamut from a federal agency to state, regional, local agencies or the consulting or plant engineer. Often the best source of information is the state Administrative Code or a state agency such as a Department of Environmental Protection (DEP), Environmental Protection Agency (EPA), Department of Health, etc.

Approval Requirements (NEC/Factory Mutual)
Class I, Division 1: suitable equipment must be explosion proof. It must also contain pilot motor thermal sensors (which must be connected in the motor control).

Class II, Division 1: suitable equipment must be “dust ignition proof” and use motor pilot surface temperature limiting thermal switches as in Class I.

Class III, Division 1: suitable equipment need only be totally enclosed, non ventilated.

Current Approvals for hazardous location pumps previously noted are by FM (Factory Mutual Research). FM is officially listed by OSHA (Occupational Safety & Health Administration) in the Federal Register as a Nationally recognized testing laboratory (NRTL). It is in all regards equivalent to UL (Underwriters Laboratory).

Restrictions: The listed (X) pumps are not approved for “process pumping” where high concentrations of liquids (other than wastewater) are handled for process work, transfer, or recovery. The acceptable usage is for handling wastewater (contaminated water, sewage, etc.) for the purposes of treatment, transfer, storage, or disposal.

No accessory equipment may be attached to an approved pump unless it is specifically approved for the location or “intrinsically safe” (See NEC 500-2 for Intrinsic Safe requirements).

WARNING: All NEC and local code requirements must be scrupulously observed when making an installation. Be certain that glands and conduits where pump(s) or control wiring/cable passes from a hazardous location (wet pit, etc.) to electrical service, controls, or nonclassified area are suitably sealed against passage of gases or liquids.

Aggressive Liquids: Depending on temperature, pH, concentration, and their intrinsic reactivity, certain contaminant chemicals (acids, alkalies, solvents, etc.) may have a deteriorating effect on the equipment and
pose a safety hazard to the installation. Be careful to fully examine these circumstances with the end user or his representative and consult with Flygt.

A number of alternative configurations or approaches are available which may make the equipment suitable in the presence of these materials: alternate elastomers, cable sheathing, special cable entries, etc.

Accessories: Non-sparking bronze “Safe-Slide®” installation/removal guide accessories are available for all approved pumps. While not required by the Approval Authority they may be desired by local authorities and do provide an extra margin of safety for particularly hazardous classified locations.

Cable: Flexible cords or cables used in hazardous locations must be of the NEC type “extra-hard usage” and be specifically approved/tested for the approved equipment (motor/pumps) which they will be used with. **No unapproved substitutions may be made without loss of official approval.** Cables supplied by Flygt and used with Flygt electric submersible pumps are FM tested and approved for the hazardous locations listed for the pumps in the beginning of this Explosion-proof pumps section.

To protect against the damaging and unsafe effects of very aggressive contaminants (liquids, dissolved solids) in the wastewater, special cable entries are available which will allow pipe or stainless steel flex hose sheathing to be attached to protect the cable.

Special Exceptions for Hazardous Locations: It is possible in some circumstances to use standard pumps in what would normally be declared as hazardous locations. These approaches are supported by various codes but may not be used if specifically disallowed by an Authority Having Jurisdiction.

Guaranteed Pump Submersion (GPS): If the equipment is so controlled that the liquid level never falls below a point 4 - 6 inches above the topmost point of the pump, then standard non-approved pumps may be used. This is because the volume below a liquid surface is not considered hazardous.

The means for guaranteeing that a pump will always remain submerged during operation vary from one part of the country to another. Consult Flygt for appropriate configurations.

Declassification: An examination of local/state administrative codes, NEC Chapter 5, and NFPA Standard 70C and 496, shows that a hazardous location may be reduced in classification from Division 1 to Division 2 or even to a nonhazardous condition through the use of suitable air purging and use of monitoring safeguards. This would then allow the installation of standard pumping equipment.

This is a common practice in many parts of the country when the installation makes it practical. The approach has additional benefits: purging not only removes any explosive/flammable gases, but also removes smothering or poisonous gases thus improving the personnel safety aspects of the location.

Mine Safety and Health Administration (MSHA) Equipment approved by MSHA (Permissible-suitable for use in gassy mines) may not be used in any hazardous location covered by the NEC categories (Class I, II, or III) without written permission of the **authority having jurisdiction**.

Nor may equipment approved/listed by FM or UL be used in a gassy mine without the written approval of MSHA.